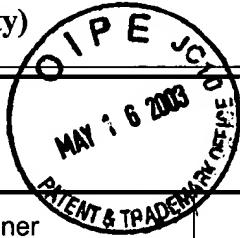


TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No.
END920000094US1

In Re Application Of: David J. Alcoe

Serial No.
09/714,373Filing Date
11/16/00Examiner
Lindinger, M.Group Art Unit
2841

Invention: COMPLIANT LAMINATE CONNECTOR

TO THE COMMISSIONER FOR PATENTS:

Transmitted herewith in triplicate is the Appeal Brief in this application, with respect to the Notice of Appeal filed on

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Docket: END920000094US1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): David J. Alcoe

Examiner: Lindinger, M.

Serial No.: 09/714,373

Art Unit: 2841

Filing Date: 11/16/00

Title: **COMPLIANT LAMINATE CONNECTOR**

Commissioner for Patents
Washington D.C. 20231

#16/Appeal
Brief
v.2
5/22/03

BRIEF OF APPELLANTS

This Appeal Brief, pursuant to the Notice of Appeal filed March 24, 2003, is an appeal from the rejection of the Examiner dated December 26, 2002.

REAL PARTY IN INTEREST

International Business Machines, Inc. is the real party in interest.

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RELATED APPEALS AND INTERFERENCES

None.

STATUS OF CLAIMS

Claims 1-44 are currently pending, claims 2 and 21 have been withdrawn from consideration.

This Brief is in support of an appeal from the rejection of claims 1, 3-20 and 22-44.

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STATUS OF AMENDMENTS

An After-Final Amendment was filed on February 18, 2003. An Advisory Action was mailed on March 12, 2003. The After-Final Amendment was entered for purposes of appeal.

SUMMARY OF THE INVENTION

The present invention discloses a method of forming an electronic device, the electronic device so formed and the connector used in the electronic device.

According to the present invention, an electronic device is formed by providing a flexible connector, and attaching the flexible connector between a first substrate and a second substrate via contacts (see Specification, page 12, lines 5-20).

The flexible connector may comprise a laminate material (see Specification, page 5, lines 14-17) having a core (see Specification, page 8, lines 4-7) surrounded by a dielectric material (see Specification, page 9, line 3). The core may comprise copper-invar-copper, copper, stainless steel, nickel, iron and molybdenum (see Specification, page 8, lines 4-7), and the dielectric material may comprise polyimide (see Specification, page 9, lines 4-7). The connector may also have solder mask over the dielectric layer (see Specification, page 9, lines 10-12), and plated through holes formed through the laminate (see Specification, page 9, lines 9-10). The connector also includes a plurality of alternating contacts on a first surface and a second surface of the flexible connector (see Specification, page 6, lines 14-17), e.g., ball grid arrays (see Specification, page 5, lines 14-17), wherein at least three contacts in succession on the first

surface alternate with at least three contacts in succession on the second surface (see Specification, page 6, lines 16-19).

The first substrate, e.g., a chip package (see Specification, page 5, lines 11-12), has a first coefficient of thermal expansion (see Specification, page 6, lines 1-7). The second substrate, e.g., a printed circuit board (see Specification, page 5, lines 11-12), has a second coefficient of thermal expansion (see Specification, page 6, lines 7-8). The flexible connector attached between the first and second substrates (see Specification, page 5, lines 12-14) has a coefficient of thermal expansion approximately midway between the first and second coefficient of thermal expansion (see Specification, page 8, lines 10-13).

The electronic device may also include a connection between at least one contact on the first surface and at least one contact on the second surface (see Specification, page 9, line 21 – page 10, line 5). A ground shield may also be included over the connection (see Specification, page 10, lines 18-21). The electronic device may further comprise a stiffener frame attached to the connector, wherein the stiffener frame surrounds a perimeter of the connector (see Specification, page 11, lines 14-16). The stiffener frame may be removably attached to the connector (see Specification, page 11, lines 18-21), for example the stiffener frame may be adhesively attached to a surface of the connector (see Specification, page 14, lines 7-12). The stiffener frame may comprise plastic, metal and ceramic (see Specification, page 11, lines 16-18; page 15, lines 3-12). The stiffener frame may also comprise a heat sink (see Specification, page 14, lines 17-20).

ISSUES

1. Whether claims 1, 20, 22, 26, 28, 31-41 and 43-44 are unpatentable under 35 U.S.C. §102(b) as being anticipated by Appelt *et al.* (US 5,900,675, hereinafter “Appelt”).
2. Whether claims 3, 4, 8, 10-12 and 32-36 are unpatentable under 35 U.S.C. §103(a) over Appelt in view of Lee (US 6,050,832).
3. Whether claims 5-7 and 23-25 are unpatentable under 35 U.S.C. §103(a) over Appelt in view of Lee in further view of Nguyen (US 5,477,933).
4. Whether claims 9 and 27 are unpatentable under 35 U.S.C. §103(a) over Appelt in view of Lee in further view of Distefano (US 6,309,915 B1).
5. Whether claims 13-19, 29-30 and 42 are unpatentable under 35 U.S.C. §103(a) over Appelt in view of Lee in further view of Sheppard (US 6,284,569 B1).

GROUPING OF CLAIMS

The claims are organized as Group 1, Group 2, Group 3, Group 4, Group 5 and Group 6. Group 1 comprises claims 1-19. Claims 1-19 stand or fall together. Group 2 comprises claims 20-30 and 44. Claims 20-30 and 44 stand or fall together. Group 3 comprises claims 31-36. Claims 31-36 stand or fall together. Group 4 comprises claims 37-41. Claims 37-41 stand or fall

together. Group 5 comprises claim 42. Group 6 comprises claim 43.

Claims 1-19 comprise a device having a flexible connector attached between a first and second substrate, wherein the coefficient of thermal expansion of the flexible connector is approximately midway between the coefficient of thermal expansion of the first and second substrates. The aforementioned feature is not present in groups 2-6.

Claims 20-30 and 44 comprise a flexible connector system having at least three contacts on a first surface of the connector alternatingly offset from at least three contacts on a second surface of the connector. The aforementioned feature is not present in groups 1 and 3-6.

Claims 31-36 comprise a method of forming the electronic device, and comprise a flexible connector having at least three contacts in succession on a first surface of the connector alternating with at least three contacts in succession on a second surface of the connector, which are not present in groups 1, 2 and 4-6.

Claims 37-41 comprise a method of forming the electronic device, and comprise at least three alternating contacts on a first surface and at least three alternating contacts on a second surface of the connector, which are not present in groups 1-3, 5 and 6.

Claim 42 comprises a method of forming an electronic device including a stiffener frame surrounding a perimeter edge of the connector, which is not present in groups 1-4 and 6.

Claim 43 comprises a connector system wherein at least three contacts are located at a far distance to a neutral point (DNP) on a first surface and at least three contacts are located at a far distance to a neutral point (DNP) on a second surface of the substrate, and wherein the contacts are off-set. The aforementioned feature is not present in groups 1-5.

ARGUMENT

Issue 1

CLAIMS 1, 20, 22, 26, 28, 31-41 AND 43-44 ARE NOT UNPATENTABLE UNDER 35 USC 102(b) OVER APPELT

The Examiner rejected claims 1, 20, 22, 26, 28, 31-41 and 43-44 under 35 USC 102(b) as being unpatentable over Appelt.

With respect to Issue 1, the Examiner alleges that “Appelt teaches a connector system comprising a first substrate 620 of a first coefficient of thermal expansion, a second substrate 630 of a second coefficient of thermal expansion, a flexible connector 610/640, at least three contacts 612, 613 formed on a first surface of the substrate, and at least three contacts 631-634 formed on a second surface of the substrate, wherein select contacts on the first surface of the substrate are alternately offset from select contacts on the second surface of the substrate, wherein the coefficient of thermal expansion of the connector is midway between the first and second coefficient of thermal expansion of the first and second substrates, respectively (Col. 4, lines 8+; Col. 5, lines 58+; Col. 6, lines 1+; Fig. 6)” (see Final Office Action of December 26, 2002, page 2, 1st paragraph).

Claim 1

With respect to claim 1, the Examiner goes on to allege that “Appelt teaches a first substrate 620 with a first coefficient of the thermal expansion of 15-25 ppm/C ... a second

substrate 620 [sic] with a second coefficient of the thermal expansion of approximately 2 ppm/C ... and a flexible connector with a coefficient of thermal expansion value (7 ppm/C) approximately midway between the first and second coefficient of thermal expansion values, respectively" (see Final Office Action of December 26, 2002, page 11, Response to Arguments).

Appellants respectfully contend that claim 1 is not unpatentable over Appelt because Appelt does not teach each and every feature of claim 1.

For example, Appelt fails to teach, *inter alia*, a connector "wherein the coefficient of thermal expansion of the connector is approximately **midway between** the first and second coefficient of thermal expansion," as recited in claim 1. The Examiner is citing text relating to a first embodiment illustrated in figure 2 in combination with an alternate embodiment illustrated in figure 6. In fact, during a telephone interview the Examiner claimed that the element numerals in figure 2 correspond to the element numerals in figure 6, and vary by a factor of 100, therefore, the requirements for figure 2 set forth in column 4 are applicable to figure 6. Appellants respectfully assert that the Examiner is in error in this assumption, and the text of figure 2 and the embodiment illustrated in figure 6 are not interchangeable. The element numerals of figure 2 and figure 6 do not differ by a factor of 100 as the Examiner tried to argue. For example, element numeral 210 is the reinforcement in figure 2, whereas the reinforcement of figure 6 is element numeral 640. If these figures were intended to be interchangeable, as the Examiner is trying to assert, the reinforcement of figure 6 would have been labeled element numeral 610, not 640. Without some sort of coordination between the element numerals of figures 2 and 6 it is inappropriate to assume that their text is interchangeable. In fact, there are no CTE values

specified in the text relating to figure 6 (see Appelt, col. 5, ln. 57- col. 6, ln. 9), therefore, one cannot assume that there are any CTE requirements for figure 6.

Furthermore, even if the CTE requirements for figure 2 were intended to pertain to figure 6, the CTE of the baseplate is not approximately **midway between** the CTE of the first and second substrates. The Examiner is also trying to combine the text corresponding to figure 2, figure 6 and the text in column 6 relating to an altogether different embodiment. Column 6, lines 25-37 details the use of a “core region of the baseplate” having a CTE “tailored to match that of a ceramic, such as Al₂O₃, (of about 7 ppm/C), typically used as a substrate”. Contrary to the Examiner’s arguments, column 6, lines 25-37 of Appelt is consistent with the requirements set forth at the outset of Appelt, namely, the core region of the baseplate directly above the chip has a CTE “close to that of the chip” (see Appelt, col.4, lns. 15-23). In fact, lines 30-33 of column 6 state that the “material selected [for the core region of the baseplate] **must** satisfy the necessary CTE requirements” (emphasis added). The “necessary CTE requirements” are detailed throughout Appelt, specifically, the CTE of the baseplate should be “close to that of [the] chip” (see Appelt, col.4, lns. 15-24). In column 6 Appelt is simply pointing out that a baseplate used in conjunction with a ceramic substrate (or chip), which has a CTE of approximately 7 ppm/C, should also have a core region with a CTE of approximately 7 ppm/C. The embodiment described in column 6 goes even further to require that the CTE be tailored to “**match**” that of the ceramic substrate. It is clear that the CTE value of 7 ppm/C specified in column 6 for the baseplate was intended to be used in conjunction with a substrate having a CTE of approximately 7 ppm/C. It was not intended to be used in conjunction with the CTE values set forth in column

4. In fact, if the CTE values for the baseplate and first and second substrates were combined as the Examiner is proposing, the basic requirements of Appelt, namely, that the CTE of the baseplate should be close to that of the chip, would be violated. It is incomprehensible to think that Appelt would require the CTE of the baseplate be as close to the chip as possible to minimize warping (see Appelt, col. 4, lns. 15-27; col. 3, lns. 20-22), and yet use a baseplate having a CTE of 7 ppm/C with substrates having CTE's of 15-25 ppm/C and 2 ppm/C. Rather, column 4 of Appelt teaches us that when using substrates having CTE values of 15-25 ppm/C and 2 ppm/C a baseplate having a CTE of approximately 3 ppm/C should be used (see Appelt, col. 4, lns. 15-27).

Appellants further point out that even if the text corresponding with figure 2, the alternate embodiment illustrated in figure 6 and the text of the alternate embodiment described in column 6 of Appelt were combined as the Examiner is suggesting, the combination still fails to teach a baseplate having a CTE approximately midway between the CTE's of the first and second substrates, as required by claim 1. Rather, the midpoint between CTE's of 2 ppm/C and 15 ppm/C is 8.5 ppm/C, not 7 ppm/C as disclosed in column 6. A CTE of 8.5 ppm/C varies from the midpoint, 7 ppm/C, by 18%. Appellants assert that a deviation from the midpoint of 18% can hardly be considered "approximately midway between" the CTE's of the first and second substrates.

Additionally, Appelt fails to teach, *inter alia*, a connector having "a plurality of contacts on a first and a second surface of the connector, wherein all of the contacts on the first and second surfaces alternate with respect to each other" (emphasis added), as recited in claim 1. As

clearly illustrated in Fig. 6 of Appelt, all the C4 connectors 631-634 on a first surface of the chip carrier 610 do not alternate with respect to all the solder ball interconnections 612-613 on a second surface of the chip carrier.

Based on the preceding arguments, Appellants respectfully maintain that claim 1 is not unpatentable over Appelt, and claim 1 is in condition for allowance. Since claims 3-19 depend from claim 1, Appellants contend that claims 3-19 are likewise in condition for allowance.

Claim 20

With respect to claim 20, the Examiner further alleges that Appelt teaches “a connector system wherein the laminate material comprises a core, a compliant, dielectric material surrounding the core” (see Final Office Action of December 26, 2002, page 3, 1st full paragraph).

Appellants respectfully contend that claim 20 is not unpatentable over Appelt because Appelt does not teach each and every feature of claim 20.

Appelt fails to teach, *inter alia*, “at least three contacts on a first surface of a substrate; at least three contacts on a second surface of the substrate, wherein the contacts on the first surface of the substrate are alternatingly off-set from the contacts on the second surface of the substrate,” as required by claim 20. As clearly illustrated in Fig. 6 of Appelt, the C4 connections 631-634 on a first surface of the chip carrier 610 are not alternatingly off-set with respect to the solder ball interconnections 612-613 on a second surface of the chip carrier 610.

Based on the preceding arguments, Appellants respectfully maintain that claim 20 is not unpatentable over Appelt, and claim 20 is in condition for allowance. Since claims 21-30 and 44

depend from claim 20, Appellants contend that claims 21-30 and 44 are likewise in condition for allowance.

Claim 22

With respect to claim 22, the Examiner goes on to allege that Appelt teaches a solder mask and refers to “Col. 5, lines 58+; Col. 6, lines 1+; Col. 7, lines 1+; FIG. 6” (see Final Office Action of December 26, 2002, page 3, 1st full paragraph).

Appellants respectfully contend that claim 22 is not unpatentable over Appelt because Appelt fails to teach a “solder mask over the compliant material”. Although the Examiner cites Col. 5, lines 58+; Col. 6, lines 1+; Col. 7, lines 1+; and FIG. 6, as containing the teaching of a solder mask, Appellants maintain that no such teaching can be found in these, or any other, sections of Appelt.

Based on the preceding arguments, Appellants respectfully maintain that claim 22 is not unpatentable over Appelt, and claim 22 is in condition for allowance.

Claim 31

With respect to claim 31, the Examiner goes on to allege that the “Appelt teachings inherently posses the method of fabricating an electronic device and connector system and the corresponding mounting and assembly steps needed to construct the apparatus” (see Final Office Action of December 26, 2002, page 3, 4th full paragraph).

Appellants respectfully contend that claim 31 is not unpatentable over Appelt because

Appelt does not teach each and every feature of claim 31.

As a first reason, Appelt fails to teach, *inter alia*, “a plurality of alternating contacts on a first surface and a second surface of the flexible connector, wherein at least three contacts in succession on the first surface alternate with at least three contacts in succession on the second surface,” as recited in claim 31. As illustrated in Figure 6 of Appelt, none of the at least three C4 connectors 631-634 in succession on a first surface of the chip carrier 610 alternate with any three solder ball interconnections 612-613 in succession on a second surface of the chip carrier 610. In order for this limitation to exist in Appelt, the fourth solder ball interconnection 612-613 from the left would have to be spatially located between C4 connector 632 and C4 connector 633. This is not the case. Instead, the fourth solder ball interconnection 612-613 from the left is spatially located between C4 connector 633 and C4 connector 634. Alternatively, the third solder ball interconnection 612-613 from the left would have to be spatially located between C4 connector 632 and C4 connector 633. Again, this is not the case. Instead, the third solder ball interconnection 612-613 from the left is spatially located between C4 connector 631 and C4 connector 632.

As a second reason, Appelt fails to teach, *inter alia*, a method of forming an electronic device, as recited by claim 31. There is no indication in Appelt as to the method used to fabricate the devices disclosed. In contrast, Appelt teaches a finished structure, not a method of forming the structure, so there is no indication of the manner in which the structure of Appelt is formed. Furthermore, the Examiner’s assertion that the teachings of Appelt “inherently” posses the

methods of fabrication is improper because the Examiner has provided no argument in support of the assertion.

In addition, there is no indication in Appelt that a connector exists at any point in time during fabrication having a plurality of alternating contacts on a first and second surface, wherein at least three contacts in succession on the first surface alternate with at least three contacts in succession on the second surface, as occurs during the method steps set forth in claim 31 of the present invention.

Based on the preceding arguments, Appellants respectfully maintain that claim 31 is not unpatentable over Appelt, and claim 31 is in condition for allowance. Since claims 32-36 depend from claim 31, Appellants contend that claims 32-36 are likewise in condition for allowance.

Claim 37

With respect to claim 37, the Examiner goes on to allege that the “Appelt teachings inherently posses the method of fabricating an electronic device and connector system and the corresponding mounting and assembly steps needed to construct the apparatus” (see Final Office Action of December 26, 2002, page 3, 4th full paragraph).

Appellants respectfully contend that claim 37 is not unpatentable over Appelt because Appelt does not teach each and every feature of claim 37.

Appelt fails to teach, *inter alia*, a method of forming an electronic device as required by claim 37. Specifically, Appelt fails to teach the method step comprising “attaching the contacts on the first surface of the connector to the first substrate and the contacts on the second surface of

the connector to the second surface". Appellants disagree with the Examiner's assertion that the method steps are inherently taught by Appelt. As discussed above in conjunction with claim 31, Appellants respectfully assert that there is no indication in Appelt as to the method used to fabricate the devices disclosed. Again, Appellants maintain that the Examiner's assertion of inherency is improper because the Examiner has provided no argument in support of the assertion.

Based on the preceding arguments, Appellants respectfully maintain that claim 37 is not unpatentable over Appelt, and claim 37 is in condition for allowance. Since claims 38-41 depend from claim 37, Appellants contend that claims 38-41 are likewise in condition for allowance.

Claim 43

Appellants assert that Appelt fails to teach, *inter alia*, "at least three contacts located at a far distance to a neutral point (DNP) on a first surface and at least three contacts located at a far distance to a neutral point (DNP) on a second surface of the substrate, wherein the contacts are off-set," as required by claim 43. Appellants respectfully assert that the rejection to claim 43 is improper because the Examiner has failed to present an argument in support of the rejection (see Final Office Action of December 26, 2002, pages 2-3).

Based on the preceding arguments, Appellants respectfully maintain that claim 43 is not unpatentable over Appelt, and claim 43 is in condition for allowance.

Issue 2

CLAIMS 3, 4, 8, 10-12 AND 32-36 ARE NOT UNPATENTABLE UNDER 35 USC 103(a)

OVER APPELT IN VIEW OF LEE

The Examiner rejected claims 3, 4, 8, 10-12 and 32-36 under 35 U.S.C. §103(a) as being unpatentable over Appelt in view of Lee.

With respect to Issue 2, the Examiner alleges that “Appelt teaches a connector system comprising a first substrate 620 of a first coefficient of thermal expansion, a second substrate 630 of a second coefficient of thermal expansion, a flexible connector 610/640, at least three contacts 612, 613 formed on a first surface of the substrate, and at least three contacts 631-634 formed on a second surface of the substrate, wherein select contacts on the first surface of the substrate are alternately offset from select contacts on the second surface of the substrate, wherein the coefficient of thermal expansion of the connector is midway between the first and second coefficient of thermal expansion of the first and second substrates, respectively (Col. 4, lines 8+; Col. 5, lines 58+; Col. 6, lines 1+; Fig. 6)” (see Final Office Action of December 26, 2002, page 4, 1st paragraph). The Examiner goes on to allege that “Lee teaches an apparatus comprising a first substrate 14, a second substrate 10, a flexible connector 218 attached between the first and second substrates by a plurality of contacts on a first and second surface of the connector, wherein all of the contacts on the first and second surfaces alternate in respect to each other.” “(Col. 6, lines 63+; Col. 7, lines 1+’ Fig. 3B)” (see Final Office Action of December 26, 2002, page 5, 1st paragraph).

The Examiner further alleges that “Lee teaches the general principle of alternating contacts in order to reduce stress within a multiple substrate and connector arrangement, however, Lee does not explicitly teach the details of that arrangement” (see Final Office Action of December 26, 2002, page 5, continuation of 1st paragraph from page 4). The Examiner claims that “[i]t would have been obvious to...provide additional contacts to the Appelt reference arranged in an offsetting manner to further reduce thermal expansion with the substrates” (see Final Office Action of December 26, 2002, page 5, 1st paragraph).

Claims 3, 4, 8 and 10-12

Appellants assert that claims 3, 4, 8 and 10-12 are not unpatentable under 35 USC 103 because independent claim 1 was not rejected under 35 USC 103, and the arguments overcoming the 35 USC 102 rejection to claim 1 was presented above.

In addition, Appellants respectfully contend that claims 3, 4, 8 and 10-12 are not unpatentable over Appelt in view of Lee because Appelt and Lee fail to teach or suggest each and every feature of claims 3, 4, 8 and 10-12.

The Examiner’s argument is not persuasive because Appelt and Lee fail to teach or suggest, *inter alia*, a “connector, wherein all of the contacts on the first and second surfaces alternate with respect to each other”, as recited in claim 1. Appellants assert that Lee fails to remedy the deficiencies of Appelt set forth in Issue 1 above. Lee’s design, utilizing a segmented interposer 118 having alternating solder balls 12 and 16, encourages movement of the various decoupled segments of the interposer 118 (see Lee, col. 5, lns. 32-36; lns. 43-45). This is in

direct opposition to Appelt, which is designed to prevent movement of the chip carrier 610 in the region of the chip 630 (see Appelt, col. 4, lns. 15-25). There would be no motivation to utilize the off-set contacts of Lee, which are intended to encourage movement of the interposer 118, with the chip carrier 610 of Appelt, having reinforcement 640 which is intended to prevent movement.

Based on the preceding arguments, Appellants respectfully maintain that claims 3, 4, 8 and 10-12 are not unpatentable over Appelt in view of Lee, and are likewise in condition for allowance.

Claims 32-36

Appellants assert that claims 32-36 are not unpatentable under 35 USC 103 because independent claim 31 was not rejected under 35 USC 103, and the arguments overcoming the 35 USC 102 rejection to claim 31 was presented above.

In addition, Appellants respectfully contend that claims 32-26 are not unpatentable over Appelt in view of Lee because Appelt and Lee fail to teach or suggest each and every feature of claims 32-26.

The Examiner's argument is not persuasive because Appelt and Lee fail to teach or suggest, *inter alia*, "at least three contacts in succession on the first surface [of the connector] that] alternate with at least three contacts in succession on the second surface [of the connector]", as required by claim 31. As mentioned above in connection with claims 3, 4, 8 and 10-12, Lee fails to remedy the deficiencies of Appelt set forth in Issue 1 above. Lee's design, utilizing a

segmented interposer 118 having alternating solder balls 12 and 16, encourages movement of the various decoupled segments of the interposer 118 (see Lee, col. 5, lns. 32-36; lns. 43-45). This is in direct opposition to Appelt, which is designed to prevent movement of the chip carrier 610 in the region of the chip 630 (see Appelt, col. 4, lns. 15-25). There would be no motivation to utilize the off-set contacts of Lee, which are intended to encourage movement of the interposer 118, with the chip carrier 610 of Appelt, having reinforcement 640 which is intended to prevent movement.

In addition, with regard to claims 32-36, Appellants assert that the Examiner's assertion that the teachings of Appelt "inherently" posses the methods of fabrication is improper because the Examiner has provided no argument in support of the assertion.

Based on the preceding arguments, Appellants respectfully maintain that claims 3, 4, 8 and 10-12 are not unpatentable over Appelt in view of Lee, and are likewise in condition for allowance.

Issue 3

CLAIMS 5-7 AND 23-25 ARE NOT UNPATENTABLE UNDER 35 USC 103(a) OVER APPELT IN VIEW OF LEE IN FURTHER VIEW OF NGUYEN

The Examiner rejected claims 5-7 and 23-25 under 35 U.S.C. §103(a) as being unpatentable over Appelt in view of Lee in further view of Nguyen.

With regard to Issue 3, the Examiner alleges that "as described in the previous rejections above, the combination of Appelt and Lee teaches a laminate material, but not a laminate

material with through holes" (see Final Office Action of December 26, 2002, page 6, 5th paragraph). But the Examiner asserts that "Nguyen teaches a laminate material with plated through holes 19 that provide electrical connection between at least one contact on the first surface 12 and one contact on the second surface 23 (Col. 3, lines 25+; Fig. 3). It would have been obvious ... to provide the laminate material within the application through holes in order to provide electrical connection between the two surfaces. By connecting the through holes by a conductive path, the solder contacts are provided increased strength and durability in protection against detachment as well" (see Final Office Action of December 26, 2002, page 6, 5th paragraph through page 7).

Claims 5, 6, 23 and 24

Appellants respectfully contend that claims 5, 6, 23 and 24 are not unpatentable over Appelt in view of Lee in further view of Nguyen because Appelt, Lee and Nguyen do not teach or suggest each and every feature of claims 5, 6, 23 and 24.

Appellants respectfully contend that claims 5 and 6 are not unpatentable over Appelt, Lee and Nguyen for the reasons set forth above in conjunction with claim 1 of Issue 1. Likewise, Appellants respectfully contend that claims 23 and 24 are not unpatentable over Appelt, Lee and Nguyen for the reasons set forth above in conjunction with claim 20 of Issue 1. In addition, Appelt, Lee and Nguyen fail to teach or suggest, *inter alia*, a plated through hole within the connector, as required by claims 5 and 23. Appellants assert that regardless of whether Nguyen teaches a conductive via 19, there is no reason to combine Nguyen with the primary reference,

Appelt. There is no indication in Appelt that electrical connection is to be made between the C4 connectors 631-634 and the solder ball interconnections 612-613 illustrated in figure 6. In fact, the C4 connectors 631-634 are surrounded by a molding compound, which acts as an encapsulating material (see Appelt, figure 6). Appelt obviously does not intend for the C4 connectors 631-634 to form electrical contact with the solder ball interconnections 612-613, therefore, there would be no motivation to form a conductive via or plated through hole in the chip carrier 610 between the C4 connectors 631-634 and the solder ball interconnections 612-613.

Likewise, Appelt, Lee and Nguyen fail to teach or suggest, *inter alia*, a connection between at least one contact on the first surface of the connector and at least one contact on the second surface of the connector, as required by claims 6 and 24. Since there is no reason to form an electrical connection in Appelt, there would be no reason to have a connection between the C4 connectors 631-634 and the solder ball interconnections 612-613.

Based on the preceding arguments, Appellants respectfully maintain that claims 5, 6, 23 and 24 are not unpatentable over Appelt in view of Lee in further view of Nguyen, and claims 5, 6, 23 and 24 are in condition for allowance.

Claims 7 and 25

With regard to claims 7 and 25, the Examiner goes on to allege that although “Appelt does not teach a ground shield over the connection layer[. and that I]t would have been obvious ... to include a ground shield over the connection layer ... in order to provide additional

impedance control for the apparatus" (see Final Office Action of December 26, 2002, page 7, 1st full paragraph).

Appellants respectfully contend that claim 7 is not unpatentable over Appelt, Lee and Nguyen for the reasons set forth *supra* in conjunction with claim 1. Likewise, Appellants respectfully contend that claim 25 is not unpatentable over Appelt, Lee and Nguyen for the reasons set forth *supra* in conjunction with claim 20.

In addition, since there would be no reason to form a connection, as discussed above, there would be no reason to form a ground shield over the connection.

Based on the preceding arguments, Appellants respectfully maintain that claims 7 and 25 are not unpatentable over Appelt in view of Lee in further view of Nguyen, and claims 7 and 25 are in condition for allowance.

Issue 4

CLAIMS 9 AND 27 ARE NOT UNPATENTABLE UNDER 35 USC 103(a) OVER APPELT IN VIEW OF LEE IN FURTHER VIEW OF DISTEFANO

The Examiner rejected claims 9 and 27 are unpatentable under 35 U.S.C. §103(a) over Appelt in view of Lee in further view of Distefano.

The Examiner alleges that "the combination of Appelt and Lee teaches a dielectric layer, but does not teach a dielectric layer comprising polyimide. Distefano teaches a dielectric layer comprising polyimide (Col. 8, lines 55+; Col. 10, lines 17+)" (see Final Office Action of December 26, 2002, page 7, 2nd full paragraph).

Claims 9 and 27

Appellants respectfully contend that claims 9 and 27 are not unpatentable over Appelt, Lee and Distefano for the reasons set forth *supra* in conjunction with claims 1 and 20, respectively. In addition, Appellants assert that the combination of Appelt and Distefano is improper. There would be no reason to combine Distefano and Appelt because Distefano requires that the dielectric element 5 be “flexible” (see Distefano, col.8, lines 55-57, emphasis added), whereas the purpose of Appelt is to minimize warping of the chip carrier/baseplate 610, (see, Appelt, col.3, lines 20-22; col. 4, lines 15-23). Appelt uses a core region of the chip carrier/baseplate 610 having a CTE close to that of the chip 630 to restrain the baseplate from moving (see, Appelt, col. 4, lines 15-23), therefore, a flexible dielectric, such as polyimide, would counteract the intentions of the baseplate.

Based on the preceding arguments, Appellants respectfully maintain that claims 9 and 27 are not unpatentable over Appelt in view of Lee in further view of Distefano, and claims 9 and 27 are in condition for allowance.

Issue 5

CLAIMS 13-19, 29-30 AND 42 ARE NOT UNPATENTABLE UNDER 35 USC 103(a) OVER APPELT IN VIEW OF LEE IN FURTHER VIEW OF SHEPPARD

The Examiner rejected claims 13-19, 29-30 and 42 as being unpatentable under 35 U.S.C. §103(a) over Appelt in view of Lee in further view of Sheppard.

The Examiner alleges that “the combination of Appelt and Lee does not teach a stiffener frame. Sheppard teaches a stiffener frame 100 providing stiffening for an integrated circuit package further comprising a stiffener frame that is attached to and surrounds the perimeter of a substrate or connector, wherein the stiffener is adhesively or removably attached to the substrate, wherein the stiffener frame comprises material selected from the group consisting of: plastic, metal, and ceramic (Col. 1, lines 57+, Col. 2, lins 6+)” (see Final Office Action of December 26, 2002, page 8, 1st paragraph). The Examiner further alleges “that as long as the general structure, which comprising the stiffener adhesively attached to a planar laminate by means of an acrylic adhesive material, then the properties of a heat sink will be achieved” (id.).

Claim 13

Appellants respectfully contend that claim 13 is not unpatentable over Appelt, Lee and Sheppard for the reasons set forth *supra* in conjunction with claim 1. Additionally, Appellants assert that the Examiner has failed to provide a reason for combining Appelt, Lee and Sheppard to teach attaching a stiffener frame to a connector, as required in claim 13.

Accordingly, Appellants respectfully maintain that claim 13 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 14

Appellants respectfully contend that claim 14 is not unpatentable over Appelt, Lee and

Sheppard for the reasons set forth *supra* in conjunction with claim 1. Additionally, Appellants assert that the Examiner has failed to provide a reason for combining Appelt, Lee and Sheppard to teach adhesively attaching a stiffener frame to a connector, as required in claim 14.

Accordingly, Appellants respectfully maintain that claim 14 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 15

Appellants respectfully contend that claim 15 is not unpatentable over Appelt, Lee and Sheppard for the reasons set forth *supra* in conjunction with claim 1.

In addition, Appellants assert that the combination of Appelt, Lee and Sheppard fail to teach or suggest, *inter alia*, a stiffener frame surrounding a perimeter of the connector, as required in claim 15. In contrast, Sheppard teaches a carrier ring 100 attached to a matrix substrate 501 in a manner illustrated in Fig. 5. As can clearly be seen, the carrier ring 100 is not **surrounding a perimeter** of the matrix substrate 501.

Furthermore, there is no reason to combine Appelt, Lee and Sheppard to teach a stiffener frame surrounding a perimeter of the connector, as required in claim 15.

Based on the preceding arguments, Appellants respectfully maintain that claim 15 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 16

Appellants respectfully contend that claim 16 is not unpatentable over Appelt, Lee and Sheppard for the reasons set forth *supra* in conjunction with claim 1. Additionally, Appellants assert that the Examiner has failed to provide a reason for combining Appelt, Lee and Sheppard to teach a stiffener frame removably attached to a connector, as required in claim 16.

Accordingly, Appellants respectfully maintain that claim 16 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 17

Appellants respectfully contend that claim 17 is not unpatentable over Appelt, Lee and Sheppard for the reasons set forth *supra* in conjunction with claim 1. Additionally, Appellants assert that the Examiner has failed to provide a reason for combining Appelt, Lee and Sheppard for attaching a stiffener frame to a surface of a connector, as required in claim 17.

Accordingly, Appellants respectfully maintain that claim 17 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 18

Appellants respectfully contend that claim 18 is not unpatentable over Appelt, Lee and Sheppard for the reasons set forth *supra* in conjunction with claim 1. Additionally, Appellants

assert that the Examiner has failed to provide a reason for combining Appelt, Lee and Sheppard for providing a stiffener frame comprising a material selected from a group consisting of: plastic, metal and ceramic, as required in claim 18.

Accordingly, Appellants respectfully maintain that claim 18 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 19

Appellants respectfully contend that claim 19 is not unpatentable over Appelt, Lee and Sheppard for the reasons set forth *supra* in conjunction with claim 1.

Accordingly, Appellants respectfully maintain that claim 19 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 29

Appellants respectfully contend that claim 29 is not unpatentable over Appelt, Lee and Sheppard for the reasons set forth *supra* in conjunction with claim 20. Additionally, Appellants assert that the Examiner has failed to provide a reason for combining Appelt, Lee and Sheppard for attaching a stiffener frame to a connector, as required in claim 29.

Accordingly, Appellants respectfully maintain that claim 29 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 30

Appellants respectfully contend that claim 30 is not unpatentable over Appelt, Lee and Sheppard for the reasons set forth *supra* in conjunction with claim 20. Additionally, Appellants assert that the Examiner has failed to provide a reason for combining Appelt, Lee and Sheppard for removably attaching a stiffener frame to a flexible substrate, as required in claim 30.

Accordingly, Appellants respectfully maintain that claim 30 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

Claim 42

Appellants respectfully contend that claim 42 is not unpatentable over Appelt because Appelt does not teach or suggest each and every feature of claim 42.

As a first reason, Appelt fails to teach or suggest, *inter alia*, a method of forming an electronic device, as required by claim 42. Specifically, Appelt fails to teach or suggest the method steps comprising “providing a flexible connector....and attaching the flexible connector between a first substrate and a second substrate via contacts”. Appellants disagree with the Examiner’s assertion that the method steps are inherently taught by Appelt. As discussed above

in conjunction with claim 31, Appellants respectfully assert that there is no indication in Appelt as to the method used to fabricate the devices disclosed, and the Examiner has failed to provide an argument in support of the assertion.

As a second reason, Appelt fails to teach or suggest, *inter alia*, a stiffener frame surrounding a perimeter of the flexible connector, as required by claim 42. In contrast, Sheppard teaches a carrier ring 100 attached to a matrix substrate 501 in a manner illustrated in Fig. 5. As can clearly be seen, the carrier ring 100 is not **surrounding a perimeter edge** of the matrix substrate 501.

Based on the preceding arguments, Appellants respectfully maintain that claim 42 is not unpatentable over Appelt in view of Lee in further view of Sheppard, and the Examiner has failed to provide *prima facie* evidence in support of the 103 rejection.

SUMMARY

In summary, Appellants respectfully request reversal of the rejections of claims 1, 3-20 and 22-44.

Respectfully submitted,

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): David J. Alcoe

Examiner: Lindinger, M.

Serial No.: 09/714,373

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Title: COMPLIANT LAMINATE CONNECTOR

Commissioner for Patents
Washington D.C. 20231

APPENDIX - CLAIMS ON APPEAL

1. An electronic device, comprising:

a first substrate having a first coefficient of thermal expansion;

a second substrate having a second coefficient of thermal expansion; and

a flexible connector attached between the first and second substrates by a plurality of contacts on a first and a second surface of the connector, wherein all of the contacts on the first and second surfaces alternate with respect to each other, and wherein the coefficient of thermal expansion of the connector is approximately midway between the first and second coefficient of thermal expansion.

3. The electronic device of claim 1, wherein the connector comprises a laminate material.

4. The electronic device of claim 3, wherein the laminate material comprises:

a core;

a dielectric material surrounding the core; and

a solder mask.

5. The electronic device of claim 4, wherein the laminate further includes a plated through hole.

6. The electronic device of claim 4, further including a connection between at least one contact on the first surface and at least one contact on the second surface.

7. The electronic device of claim 6, further including a ground shield over the connection.

8. The electronic device of claim 4, wherein the core comprises a material selected from the group consisting of: copper-invar-copper, copper, stainless steel, nickel, iron and molybdenum.

9. The electronic device of claim 4, wherein the dielectric material comprises polyimide.

10. The electronic device of claim 1, wherein the contacts comprise ball grid array connections.

11. The electronic device of claim 1, wherein the first substrate comprises a chip package.

12. The electronic device of claim 1, wherein the second substrate comprises a printed circuit board.

13. The electronic device of claim 1, further comprising a stiffener frame attached to the connector.

14. The electronic device of claim 13, wherein the stiffener frame is adhesively attached to the connector.

15. The electronic device of claim 13, wherein the stiffener frame surrounds a perimeter of the connector.

16. The electronic device of claim 13, wherein the stiffener frame is removably attached to the connector.

17. The electronic device of claim 13, wherein the stiffener frame is attached to a surface of the connector.

18. The electronic device of claim 13, wherein the stiffener frame comprises a material selected from the group consisting of: plastic, metal and ceramic.

19. The electronic device of claim 13, wherein the stiffener frame comprises a heat sink.

20. A connector system, comprising:

a flexible substrate having a core surrounded by a compliant material;

at least three contacts on a first surface of the substrate; and

at least three contacts on a second surface of the substrate, wherein the contacts on the first surface of the substrate are alternatingly off-set from the contacts on the second surface of the substrate.

22. The connector system of claim 20, wherein the flexible substrate further comprises:

a solder mask over the compliant material.

23. The connector system of claim 20, wherein the flexible substrate further includes a plated through hole.

24. The connector system of claim 20, further including a connection between at least one contact on the first surface and at least one contact on the second surface.

25. The connector system of claim 20, further including a ground shield over the connection.

26. The connector system of claim 20, wherein the core comprises a material selected from the group consisting of: copper-invar-copper, copper, stainless steel, nickel, iron and molybdenum.

27. The connector system of claim 44, wherein the dielectric material comprises polyimide.

28. The connector system of claim of 20, wherein the contacts comprise ball grid array connections.

29. The connector system of claim 20, further including a stiffener frame.

30. The connector system of claim 29, wherein the stiffener frame is removably attached to the flexible substrate.

31. A method of forming an electronic device, comprising:

providing a flexible connector having a core surrounded by a compliant material, and a plurality of alternating contacts on a first surface and a second surface of the flexible connector, wherein at least three contacts in succession on the first surface alternate with at least three contacts in succession on the second surface; and

attaching the flexible connector between a first substrate and a second substrate via the contacts.

32. The method of claim 31, wherein the flexible connector comprises a laminate material.

33. The method of claim 31, wherein the contacts comprises ball grid array connections.

34. The method of claim 31, wherein select contacts on the first surface of the flexible connector are off-set from select contacts on the second surface of the flexible connector.

35. The method of claim 31, wherein the first substrate comprises a chip package.

36. The method of claim 31, wherein the second substrate comprises a printed circuit board.

37. A method of forming an electronic device, comprising:

- providing a first substrate having a first coefficient of thermal expansion;
- providing a second substrate having a second coefficient of thermal expansion;
- providing a flexible connector having a coefficient of thermal expansion between the first and second coefficient of thermal expansion, and having at least three alternating contacts on a first surface and at least three alternating contacts on a second surface of the connector; and
- attaching the contacts on the first surface of the connector to the first substrate and the contacts on the second surface of the connector to the second substrate.

38. The method of claim 37, wherein the first substrate comprises a chip package.

39. The method of claim 37, wherein the second substrate comprises a printed circuit board.

40. The method of claim 37, wherein the flexible connector comprises a laminate material.

41. The method of claim 37, wherein the contacts comprise ball grid array connections.

42. A method of forming an electronic device, comprising:

providing a flexible connector having a plurality of alternating contacts on a first surface and a second surface of the flexible connector, and a stiffener frame surrounding a perimeter edge of the flexible connector; and

attaching the flexible connector between a first substrate and a second substrate via the contacts.

43. A connector system, comprising:

a flexible substrate having a core surrounded by a compliant material; and
at least three contacts located at a far distance to a neutral point (DNP) on a first surface and at least three contacts located at a far distance to a neutral point (DNP) on a second surface of the substrate, wherein the contacts are off-set.

44. The connector system of claim 20, wherein the compliant material comprises a dielectric material.